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# PRECIPITATION ON THE ISLANDS ALONG THE CHINESE COAST

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On rainfall maps of China, it may often be noticed that the yearly rainfall on the islands along the coast is less than that on the continent in their neighborhood.

Asia has a monsoon climate par excellence. In summer the rainfall is received under the influence of the summer monsoon; the southeast monsoon does not directly yield any rainfall,[1] but it is obvious that this wind is the source or reservoir of water vapor which, under certain conditions, especially when this warm and damp air mass is lifted up by relatively colder and drier northerly air currents, brings rain.

A glance at the mean annual rainfall map of China will show that the precipitation in general is much more abundant near the sea coast than in the interior of the country; but toward the very margin of the sea coast, and especially on the islands along the shore, the rainfall decreases again.

In general, the rainfall in a continental climate is concentrated in the summer season; while that of a marine climate comes mostly in autumn and winter, sometimes also in spring, but seldom in summer. In the region of a continental climate, the summer rainfall exceeds considerably that of winter; in a region of extreme continentality, the rainfall of the three summer months may form about 60 percent of the yearly total.[2] In a region of marine climate, though the rainfall is rather more abundant in winter and autumn, yet its distribution throughout the whole year is relatively even, certainly not so extreme as in the case of a continental climate. For example, Peiping is situated in latitude 39°54′ N, and Madrid in 40°24′ N; hence they lie practically in the same latitude, but because the former has a continental climate while the latter has a marine climate, their rainfall distributions through the year are quite different, as shown by table 1. Moreover, at Peiping the rainfall in each of the 8 months from October to May is less than that of Madrid in the same months; but during the remaining 4 months, June to September, the rainfall of Peiping exceeds that of Madrid enormously, and consequently the yearly total at Peiping is greater than that of Madrid.

In general, in the Temperate Zone the western part of a continent has a marine climate, and its rainfall comes mostly in autumn and winter; while the eastern part has a continental climate, and its rainfall is concentrated in summer. China is situated on the eastern side of the Eurasian continent, therefore its climate is quite continental; but the degree of continentality decreases as the coast line is approached. On the Pacific seaboard and on the islands, the climate has a more oceanic character than that of regions lying farther inland. The difference between the rainfall distributions of island and interior stations of China resembles that existing between Madrid and Peiping. The author has paired the stations on the islands with the neighboring stations on the mainland in order to compare the monthly means, as shown on the accompanying map and in table 2.

The most nearly ideal pair is formed by the stations Woosung and Gutzlaff. During the 8 months from October to May the mean monthly values for Gutzlaff are all greater than those of Woosung, but from June to September Woosung receives much more rain than Gutzlaff. The total at Woosung is, therefore, greater than that of Gutzlaff. This is precisely the difference existing between Peiping and Madrid; Madrid, however, has a marine climate and the precipitation in summer is the smallest, while Gutzlaff, on the other hand, still belongs to the continental climate of eastern Asia, though its continentality is slightly affected by its insular character; and therefore the rainfall is more in summer and spring. That the rainfall at Woosung exceeds that of Gutzlaff from June to September may be explained as follows: On the continent in summer the temperature is higher (table 3), and convection is more vigorous and produces more thunderstorms; on the islands, on the contrary, the summer temperature is lower, the wind stronger (table 4), and the frequency of thunderstorms naturally smaller.

TABLE 1.—*The mean monthly rainfalls of Peiping and Madrid* (*mm*)

| | January | February | March | April | May | June | July | August | September | October | November | December | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Peiping | 4.1 | 4.2 | 9.0 | 16.1 | 33.1 | 82.6 | 255.4 | 146.8 | 57.1 | 17.7 | 8.8 | 2.2 | 637.1 |
| Madrid | 33.0 | 32.2 | 40.3 | 41.8 | 42.4 | 34.1 | 9.7 | 12.5 | 37.2 | 45.6 | 50.7 | 40.4 | 420.9 |
| Range | −28.9 | −28.0 | −31.3 | −25.7 | −9.3 | +48.5 | +245.7 | +134.3 | +19.9 | −27.9 | −41.9 | −38.2 | +216.2 |

The rainfall of all seasons except summer on the northern islands surpasses that on the neighboring mainland, but decreases gradually until the group Wenchow and Peiyushan is reached, and south of this group the rainfall is always more on the continent than on the islands (except that in October the rainfalls of Chapel Island and Lamocks are a little higher than those of their respective neighboring stations Amoy and Swatow). This is probably because the stations south of Pagoda Anchorage and Tung Yung are near the Tropical Zone. In the tropical belt the air temperature throughout the whole year is always higher on the continents than on the islands in their vicinity; accordingly, the rainfall on the continent through

[1] Cochin Chu: The Enigma of Southeast Monsoon in China. Journal of the Geographical Society of China, vol. I, no. 1, p. 1, Nanking, September 1934.
[2] Hann-Süring: Lehrbuch der Meteorologie, 4th Ed., p. 366, Leipzig, 1926.

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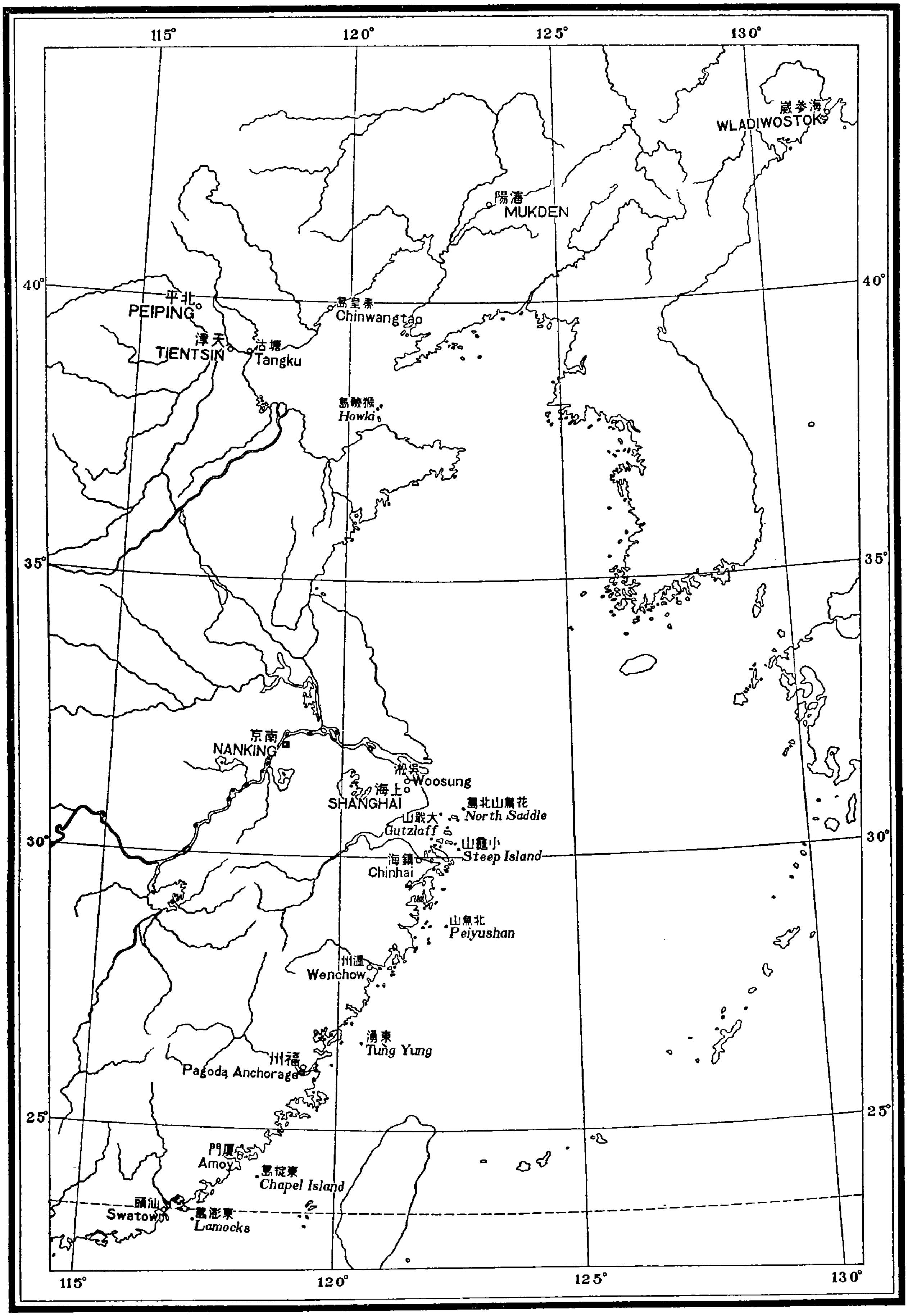
115°
120°
125°
130°
40°
35°
30°
25°
WLADIWOSTOK
MUKDEN
平北
PEIPING
津天
TIENTSIN
Tangku
Chinwangtao
Howki
京南
NANKING
Woosung
海上
SHANGHAI
North Saddle
Gutzlaff
Steep Island
Chinhai
Peiyushan
Wenchow
Tung Yung
州福
Pagoda Anchorage
門厦
Amoy
Chapel Island
Swatow
Lamocks

the whole year is more abundant than on the islands. In the Temperate Zone, in summer the air temperature on the continent is higher than that on the ocean, and vice versa in winter; and the relative rainfall distribution follows a like variation, i. e., in summer more rain falls on the continent than on the islands, and conversely in winter.

Although air over islands is in general relatively humid, yet unless some influence acts to make it rise, appreciable precipitation cannot be produced;[3] and consequently, on the islands along the Chinese coast the opportunities for rain formation are in general much more limited than on the continent. Even in summer the temperature on the islands is always lower than on the continent (table 3), and the wind force on the islands is also stronger (table 4), whence the chances for extensive vertical convection and consequent production of thunderstorms are lessened. The islands are farther away from the center of the continent, and cold continental air currents, which might underrun the warm air, sometimes fail to reach them, or become weakened before reaching them. The altitude of the islands is generally not very great, and behind them there are no high mountains or steep cliffs; the southeasterly air current can easily pass over them, without being forced to ascend to higher levels.

Along the Chinese coast the distribution of rainfall is closely related to the local temperature. Where temperature is high, rain is generally plentiful; where temperature is low, rainfall is scanty. In table 2 it is shown that rainfall increases from north to south, both on the islands and on the continent; the temperatures show the same trend (table 3). Moreover, the yearly mean temperatures at stations on the continent are usually higher than those on the islands in their vicinity; similarly the mean yearly precipitations are higher on the continent. In the subtropical belt the rainfall on the islands for all seasons except summer is generally more plentiful than on the continent; it should therefore be expected that the temperature on the islands during all seasons other than summer should be higher than on the continent. From table 3 this is found to be true in general, though there are some discrepancies. The group Peiping and Chinwangtao does not conform to the rule; but for the other groups, from north of Mukden and Vladivostok southward to Chinhai and Steep Island the mean monthly temperatures on the islands from September to February are higher than those on the continent in their neighborhood. South of Chinhai and Steep Island there is no such relation; the monthly mean temperatures on the continent through the whole year all are higher than on the islands, except that in November the mean temperature of Lamocks is a little higher than at Swatow. The monthly rainfalls on the continent from Pagoda Anchorage and Tung Yung southward are always more than on the islands.

From the above discussion it is clear that the precipitation along the seaboard of China is more or less controlled by the temperature; this seems also to be true in other parts of the world where conditions are similar. The yearly mean temperatures on islands in either temperate or tropical regions are generally lower than those on the seaboard of a continent, and this explains why the yearly rainfall on the islands in these regions is always less than on the coast. In Germany and France similar phenomena occur in the coastal regions;[4] in Java the same condition also prevails.[5] Therefore the hypothesis that the low mean annual rainfall on the islands off the Chinese coast as compared with neighboring stations on the mainland is due to their comparative low temperature seems to be well founded.

Hellmann discovered from the weather records of 13 years at Schleswig-Holstein, Germany, that in the colder half year (October to March) there is more rainfall on the coastal belt than at inland stations; the reverse is true in summer. The difference in rainfall between coastal and inland stations is greater in the summer half year than in the colder half year. On the lighthouse of Anrum the winter rainfall exceeded that at Wyk on Föhr Island by more than 8 mm; but in summer, on the contrary, the former had 34 mm less than the latter. In Germany another example is provided by Westerland on Sylt Island, and Tondern, lying 13 km inland; in summer the rainfall of Tondern exceeds that at Westerland by 85 mm; in winter Tondern receives 49 mm less. In France at Gascogne, Languedoc, Dunkerque and Vendée, and along the coastal regions of Belgium, the same relations exist. Table 5 shows the seasonal distribution of rainfall in the district of Dunkerque, where the rainfall increases in all seasons of the year with increasing distance from the sea.

[3] Coching Chu: The Climatic Factors of China. Journal of the Geographical Society of China, vol. II, no. 2, p. 16, Nanking, June 1935.

[4] Hellmann: Über die relative Regenarmuth der deutschen Flachküsten. Sitzgsber. der K. pr. Akad. der Wissenschaften, Band LIV, 1904; Niederschläge in den norddeutschen Stromgebieten, Berlin 1906.
M. R. Blanchard. La pluviosité de la plaine du nord de la France. Annales de Géographie, vol. 11, 1902.
M. Sorre, Régime pluviométrique de la Vendée. Annales Géographie, vol. 13, 1904.
Goutereau. Distribution des pluies sur les plaines maritimes. Annuaire de Soc. Meteor., 1905.

[5] Niemeyer. De regenval de vlakke kusten van Java, Leiden, 1906.

TABLE 2.—*Comparison of rainfall on continental and insular stations (mm)*

| | January | February | March | April | May | June | July | August | September | October | November | December | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mukden | 4 | 7 | 18 | 29 | 55 | 87 | 147 | 135 | 85 | 38 | 22 | 5 | 632 |
| Vladivostok | 7 | 9 | 16 | 31 | 50 | 70 | 77 | 110 | 112 | 46 | 29 | 13 | 570 |
| Difference | −3 | −2 | +2 | −2 | +5 | +17 | +70 | +25 | −27 | −8 | −7 | −8 | +62 |
| Peiping | 4.1 | 4.2 | 9.0 | 16.1 | 33.1 | 82.6 | 255.4 | 146.8 | 57.1 | 17.7 | 8.8 | 2.2 | 637.1 |
| Chinwangtao | 3.1 | 2.8 | 14.9 | 17.2 | 63.5 | 68.6 | 177.9 | 193.9 | 68.3 | 20.1 | 12.2 | 3.1 | 645.6 |
| Difference | +1.0 | +1.4 | −5.9 | −1.1 | −30.4 | +14.0 | +77.5 | −47.1 | −11.2 | −2.4 | −3.4 | −.9 | −8.5 |
| Tientsin | 4.3 | 2.9 | 9.1 | 16.2 | 27.0 | 59.8 | 180.4 | 147.8 | 47.6 | 15.2 | 10.6 | 4.0 | 524.9 |
| Howki | 4.5 | 7.1 | 8.5 | 20.6 | 34.0 | 55.3 | 136.8 | 102.7 | 52.3 | 20.3 | 17.1 | 4.9 | 464.1 |
| Difference | −.2 | −4.2 | +.6 | −4.4 | −7.0 | +4.5 | +43.6 | +45.1 | −4.7 | −5.1 | −6.5 | −.9 | +60.8 |
| Tangku | 4.5 | 3.1 | 8.4 | 11.9 | 29.8 | 66.0 | 176.0 | 140.0 | 42.0 | 13.6 | 11.7 | 2.8 | 509.8 |
| Howki | 4.5 | 7.1 | 8.5 | 20.6 | 34.0 | 55.3 | 136.8 | 102.7 | 52.3 | 20.3 | 17.1 | 4.0 | 464.1 |
| Difference | 0 | −4.0 | −.1 | −8.7 | −4.2 | +10.7 | +39.2 | +37.3 | −10.3 | −6.7 | −5.4 | −2.1 | +45.7 |
| Woosung | 38.4 | 48.2 | 68.9 | 83.7 | 81.1 | 172.1 | 148.1 | 119.0 | 122.5 | 50.7 | 49.9 | 36.4 | 1,019.0 |
| Gutzlaff | 45.6 | 58.0 | 87.0 | 91.7 | 83.0 | 144.3 | 90.4 | 66.6 | 111.4 | 61.4 | 50.2 | 38.4 | 928.0 |
| Difference | −7.2 | −9.8 | −18.1 | −8.0 | −1.9 | +27.8 | +57.7 | +52.4 | +11.1 | −10.7 | −.3 | −2.0 | +91.0 |

TABLE 2.—*Comparison of rainfall on continental and insular stations (mm)*—Continued

| | January | February | March | April | May | June | July | August | September | October | November | December | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wenchow | 48.0 | 89.9 | 125.6 | 143.4 | 187.6 | 263.1 | 200.4 | 252.7 | 213.0 | 87.4 | 55.5 | 43.1 | 1,709.7 |
| Peiyushan | 49.7 | 86.5 | 107.2 | 107.0 | 127.4 | 157.4 | 74.0 | 105.5 | 171.0 | 61.8 | 56.7 | 55.3 | 1,159.5 |
| Difference | −1.7 | +3.4 | +18.4 | +36.4 | +60.2 | +105.7 | +126.4 | +147.2 | +42.0 | +25.6 | −1.2 | −12.2 | +550.2 |
| Pagoda Anchorage | 44.5 | 92.3 | 118.8 | 126.4 | 151.0 | 195.7 | 167.0 | 199.6 | 205.9 | 46.8 | 41.2 | 47.7 | 1,436.9 |
| Tung Yung | 22.0 | 60.2 | 77.8 | 78.0 | 114.2 | 115.2 | 54.9 | 84.6 | 83.9 | 35.7 | 23.9 | 19.4 | 769.8 |
| Difference | +22.5 | +32.1 | +41.0 | +48.4 | +36.8 | +80.5 | +112.1 | +115.0 | +122.0 | +11.1 | +17.3 | +28.3 | +667.1 |
| Amoy | 34.5 | 68.1 | 91.4 | 133.4 | 169.5 | 174.6 | 126.9 | 161.4 | 109.9 | 37.4 | 33.4 | 35.1 | 1,175.6 |
| Chapel Island | 33.1 | 59.7 | 89.9 | 127.6 | 130.2 | 135.0 | 114.1 | 113.4 | 88.1 | 41.3 | 31.0 | 29.4 | 992.8 |
| Difference | +1.4 | +8.4 | +1.5 | +5.8 | +39.3 | +39.6 | +12.8 | +48.0 | +21.8 | −3.9 | +2.4 | +5.7 | +182.8 |
| Swatow | 34.9 | 58.4 | 84.2 | 146.0 | 216.0 | 256.4 | 205.6 | 213.9 | 133.1 | 62.2 | 42.8 | 36.8 | 1,490.5 |
| Lamocks | 27.8 | 34.6 | 59.8 | 100.8 | 117.4 | 165.0 | 170.4 | 147.7 | 120.9 | 74.1 | 26.7 | 23.6 | 1,068.8 |
| Difference | +7.1 | +23.8 | +24.4 | +45.2 | +98.6 | +91.4 | +35.2 | +66.2 | +12.2 | −11.9 | +16.1 | +13.2 | +421.7 |

TABLE 3.—*Comparison of temperatures at continental and insular stations (° C.)*

| | January | February | March | April | May | June | July | August | September | October | November | December | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mukden | −13.3 | −10.0 | −1.3 | 8.3 | 15.6 | 21.4 | 24.7 | 23.6 | 16.3 | 9.1 | −1.6 | −10.0 | 6.8 |
| Vladivostok | −13.7 | −10.1 | −3.1 | 4.5 | 9.5 | 13.8 | 18.1 | 20.6 | 16.5 | 9.3 | −.5 | −9.6 | 4.6 |
| Difference | +.4 | +.1 | +1.8 | +3.8 | +6.1 | +7.6 | +6.6 | +3.0 | −.2 | −.2 | −1.1 | −.4 | +2.2 |
| Peiping | −4.5 | −1.5 | 5.1 | 13.8 | 20.3 | 24.7 | 26.4 | 25.3 | 20.1 | 12.5 | 4.0 | −2.7 | 11.9 |
| Chinwangtao | −6.1 | −4.5 | 1.7 | 9.4 | 15.8 | 20.7 | 24.5 | 24.2 | 19.7 | 12.3 | 3.6 | −1.7 | 9.9 |
| Difference | +1.6 | +3.0 | +3.4 | +4.4 | +5.5 | +4.0 | +1.9 | +1.1 | +.4 | +.2 | +.4 | −1.0 | +2.0 |
| Tangku | −4.4 | −2.4 | 4.2 | 12.2 | 19.4 | 23.9 | 26.7 | 25.7 | 21.5 | 13.8 | 4.3 | 1.7 | 11.9 |
| Howki | −2.3 | −2.1 | 2.3 | 8.4 | 14.8 | 19.2 | 22.9 | 23.9 | 21.1 | 15.1 | 7.6 | 1.2 | 11.2 |
| Difference | −2.1 | −.3 | +1.9 | +3.8 | +4.6 | +4.7 | +3.8 | +1.8 | +.4 | −1.3 | −3.3 | +.5 | +.7 |
| Shanghai | 3.3 | 4.0 | 7.8 | 13.4 | 18.6 | 22.9 | 26.8 | 26.8 | 22.7 | 17.4 | 11.1 | 5.6 | 15.0 |
| North Saddle | 5.5 | 5.6 | 8.5 | 12.8 | 17.3 | 21.6 | 25.9 | 26.8 | 23.3 | 19.2 | 14.2 | 9.6 | 15.9 |
| Difference | −2.2 | −1.6 | −.7 | +.6 | +1.3 | +1.3 | +.9 | 0 | −.6 | −1.8 | −3.1 | −4.0 | −.9 |
| Woosung | 4.1 | 4.5 | 8.6 | 13.9 | 19.1 | 23.2 | 27.1 | 27.5 | 23.4 | 18.1 | 12.2 | 7.7 | 15.9 |
| Gutzlaff | 4.4 | 4.5 | 7.9 | 12.5 | 17.1 | 21.6 | 25.7 | 26.9 | 23.5 | 19.1 | 13.6 | 8.6 | 15.4 |
| Difference | −.3 | 0 | +.7 | +1.4 | +2.0 | +1.6 | +1.4 | +.6 | −.1 | −1.0 | −1.4 | −.9 | +.5 |
| Chinhai | 4.4 | 5.2 | 9.2 | 14.6 | 19.4 | 23.5 | 27.8 | 27.8 | 23.8 | 18.6 | 13.1 | 8.1 | 16.3 |
| Steep Island | 5.9 | 5.5 | 8.8 | 13.0 | 17.5 | 22.0 | 26.0 | 27.3 | 24.2 | 20.2 | 14.9 | 10.1 | 16.3 |
| Difference | −1.5 | −.3 | +.4 | +1.6 | +1.9 | +1.5 | +1.8 | +.5 | −.4 | −1.6 | −1.8 | −2.0 | 0 |
| Wenchow | 7.2 | 8.1 | 11.8 | 17.0 | 21.5 | 25.4 | 29.1 | 29.5 | 25.7 | 20.6 | 15.6 | 11.4 | 18.6 |
| Peiyushan | 6.3 | 6.2 | 9.2 | 13.6 | 18.4 | 22.6 | 26.6 | 27.2 | 24.3 | 19.9 | 15.2 | 10.5 | 16.7 |
| Difference | +.9 | +1.9 | +2.6 | +3.4 | +3.1 | +2.8 | +2.5 | +2.3 | +1.4 | +.7 | +.4 | +.9 | +1.9 |
| Pagoda Anchorage | 10.5 | 10.3 | 15.8 | 18.5 | 23.0 | 26.2 | 28.4 | 28.5 | 26.1 | 21.9 | 17.6 | 14.0 | 20.1 |
| Tung Yung | 9.1 | 8.5 | 11.2 | 15.7 | 19.6 | 24.0 | 26.8 | 27.2 | 25.3 | 21.1 | 17.0 | 13.1 | 18.2 |
| Difference | +1.4 | +1.8 | +4.6 | +2.8 | +3.4 | +2.2 | +1.6 | +1.3 | +.8 | +.8 | +.6 | +.9 | +1.9 |
| Amoy | 13.6 | 13.1 | 15.4 | 19.8 | 24.5 | 27.0 | 29.0 | 28.9 | 27.8 | 24.2 | 20.1 | 16.6 | 21.7 |
| Chapel Island | 12.2 | 11.3 | 13.4 | 17.9 | 22.6 | 25.6 | 27.3 | 27.3 | 26.5 | 22.7 | 18.8 | 15.4 | 20.1 |
| Difference | +1.4 | +1.8 | +2.0 | +1.9 | +1.9 | +1.4 | +1.7 | +1.6 | +1.3 | +1.5 | +1.3 | +1.2 | +1.6 |
| Swatow | 13.6 | 13.6 | 15.8 | 20.6 | 25.0 | 27.3 | 28.3 | 28.3 | 26.9 | 23.3 | 19.1 | 16.4 | 21.5 |
| Lamocks | 13.1 | 12.3 | 14.4 | 19.5 | 23.5 | 25.5 | 26.7 | 26.5 | 26.1 | 23.0 | 19.3 | 16.1 | 20.3 |
| Difference | +.5 | +1.3 | +1.4 | +1.1 | +1.5 | +1.8 | +1.6 | +1.8 | +.8 | +.3 | −.2 | +.3 | +1.2 |

TABLE 4.—*Comparison of wind force at continental and insular stations (Beaufort scale)*

| | January | February | March | April | May | June | July | August | September | October | November | December | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tangku | 1.6 | 1.6 | 1.9 | 2.0 | 1.8 | 1.7 | 1.3 | 1.1 | 1.3 | 1.5 | 1.6 | 1.4 | 1.6 |
| Howki | 3.2 | 3.0 | 3.1 | 2.9 | 2.5 | 2.2 | 2.1 | 2.0 | 2.5 | 2.8 | 3.1 | 3.2 | 2.7 |
| Difference | −1.6 | −1.4 | −1.2 | −.9 | −.7 | −.5 | −.8 | −.9 | −1.2 | −1.3 | −1.5 | −1.8 | −1.1 |
| Woosung | 2.1 | 1.9 | 1.9 | 1.9 | 1.9 | 1.8 | 2.1 | 1.9 | 1.8 | 1.8 | 1.5 | 1.9 | 1.9 |
| Gutzlaff | 3.6 | 3.2 | 3.2 | 3.1 | 2.9 | 2.7 | 3.1 | 2.8 | 2.9 | 3.1 | 2.9 | 3.6 | 3.1 |
| Difference | −1.5 | −1.3 | −1.3 | −1.2 | −1.0 | −.9 | −1.0 | −.9 | −1.1 | −1.3 | −1.4 | −1.7 | −1.2 |
| Chinhai | 1.8 | 1.9 | 1.5 | 1.7 | 1.5 | 1.2 | 1.6 | 1.5 | 1.7 | 1.9 | 1.6 | 1.6 | 1.6 |
| Steep Island | 3.5 | 3.0 | 2.9 | 2.6 | 2.5 | 2.4 | 2.7 | 2.4 | 2.9 | 3.0 | 2.9 | 3.1 | 2.8 |
| Difference | −1.7 | −1.1 | −1.4 | −.9 | −1.0 | −1.2 | −1.1 | −.9 | −1.2 | −1.1 | −1.3 | −1.5 | −1.2 |

TABLE 4.—*Comparison of wind force at continental and insular stations (Beaufort scale)*—Continued

| | January | February | March | April | May | June | July | August | September | October | November | December | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wenchow | 1.4 | .9 | .9 | 2.4 | 2.0 | .7 | 1.4 | 1.3 | 1.0 | 1.2 | 1.0 | 1.1 | 1.4 |
| Peiyushan | 4.2 | 3.9 | 3.2 | 2.6 | 2.6 | 2.3 | 2.8 | 2.7 | 3.1 | 3.5 | 3.3 | 3.7 | 3.2 |
| Difference | −2.8 | −3.0 | −2.3 | −.2 | −.6 | −1.6 | −1.4 | −1.4 | −2.1 | −2.3 | −2.3 | −2.6 | −1.8 |
| Pagoda Anchorage | 1.4 | 1.4 | 1.4 | 1.2 | 1.4 | 1.3 | 1.6 | 1.6 | 1.6 | 1.8 | 1.8 | 1.7 | 1.5 |
| Tung Yung | 4.0 | 3.8 | 3.5 | 3.4 | 3.1 | 3.2 | 3.7 | 3.4 | 3.5 | 4.0 | 3.9 | 3.8 | 3.5 |
| Difference | −2.6 | −2.4 | −2.1 | −2.2 | −1.7 | −1.9 | −2.1 | −1.8 | −1.9 | −2.2 | −2.1 | −2.1 | −2.0 |
| Amoy | 2.8 | 2.6 | 2.6 | 2.4 | 2.5 | 2.6 | 2.6 | 2.5 | 2.6 | 2.9 | 2.7 | 2.6 | 2.6 |
| Chapel Island | 4.2 | 4.0 | 3.6 | 2.8 | 2.9 | 2.8 | 2.4 | 2.4 | 3.3 | 4.5 | 4.2 | 4.0 | 3.5 |
| Difference | −1.4 | −1.4 | −1.0 | −.4 | −.4 | −.2 | +.2 | +.1 | −.7 | −1.6 | −1.5 | −1.4 | −.9 |
| Swatow | 1.9 | 2.1 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 2.0 | 1.9 | 1.8 | 1.8 | 1.8 |
| Lamocks | 4.0 | 3.8 | 3.7 | 3.1 | 2.8 | 2.6 | 2.3 | 2.3 | 3.3 | 4.4 | 4.1 | 3.8 | 3.4 |
| Difference | −2.1 | −1.7 | −1.9 | −1.3 | −1.0 | −.8 | −.5 | −.5 | −1.3 | −2.5 | −2.3 | −2.0 | −1.6 |

TABLE 5

| Stations | Distance from the sea | Altitude | Winter | Spring | Summer | Autumn | Year |
|---|---|---|---|---|---|---|---|
| | *km* | *m* | *mm* | *mm* | *mm* | *mm* | *mm* |
| Dunkerque | 0 | 7 | 110 | 96 | 147 | 188 | 541 |
| Les Moeres | 5 | 1 | 133 | 122 | 180 | 227 | 662 |
| Bergues | 10 | 7 | 143 | 124 | 178 | 228 | 673 |
| Steene | 10 | 8 | 150 | 114 | 164 | 215 | 643 |
| Wormhoudt | 20 | 17 | 150 | 128 | 192 | 249 | 719 |
| Nordpeene | 25 | 20 | 153 | 147 | 196 | 247 | 743 |

# CLIMATE OF THE ROGUE RIVER VALLEY, OREG.

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The Rogue River Valley represents an area of about 300 square miles, carved out of the Klamath Plateau of southwestern Oregon by the Rogue River and its major tributaries. The elevation of the arable valley floor ranges from slightly under 1,000 feet at Grants Pass to 2,000 feet in the upper Bear Creek Valley, southeast of Ashland. The region is surrounded on all sides by mountains that rise to elevations of from 4,000 to 7,000 feet.

The economic basis of the Rogue River valley consists largely of general farming of a rather intensive nature, some mining, and an increasing health resort and tourist business. Its agricultural specialization consists of pears; it is one of the largest three commercial pear-producing regions in the United States.

So much of the economic development of the valley depends upon its distinctive climatic conditions that a résumé of the climatological environment is prerequisite to an understanding of the region.

## RAINFALL

Climatically the Rogue River Valley is located in the southern part of the north Pacific climatic province; that is, it represents the more arid phase of the Marine Temperate or West Coast Cyclonic type. The American Mediterranean lies to the south in central and southern California and the Arid Continental lies to the east in the lee of the Cascade Mountains. Because it is situated some 60 to 100 miles inland, with a mountain interval between the valley and the coast, certain characteristics of both a subtropical and a continental nature are in evidence. Many of the older homes in Medford and Ashland have palm trees in their yards. They are not too vigorous in appearance, to be sure, nevertheless palm and pine meet in the Rogue River Valley, and at least two pomegranate trees have weathered some 30 or 40 years in the town of Jacksonville.

The maximum rainfall occurs in winter when the mild, moisture-laden winds from the Pacific blow across the cooler lands. The annual precipitation may be as heavy as 40 to 80 inches in the surrounding mountains; but the fact that the agricultural sections in the valleys lie from 2,000 to 6,000 feet lower than the surrounding territory, places the entire region within the rain-shadow of the ranges, definitely reducing the amount of precipitation that might otherwise be expected, and resulting, in fact, in a dry valley island within the Klamath Plateau. Down in the valley proper the average annual rainfall runs from 25 to 30 inches near Grants Pass where a considerable orographic precipitation carried over from the coastal mountains is still in evidence, to around 15 at Medford, the center of the "island."

The minimum rainfall occurs in summer. Except for occasional light convectional showers July and August are practically rainless. There are several reasons for the summer drought conditions. During the summer months a dominant anticyclonic area, the Cape Mendocino HIGH, lies off the coast in the north Pacific. Winds blowing outward on the eastern side of this HIGH have little opportunity to take up moisture before reaching the coast. Furthermore, during the summer the land becomes warmer than the ocean. The winds tend to warm up as they progress over the land, increasing the vapor capacity, and hence they are drying winds rather than moisture-giving winds. This tendency is further aggravated by the fact that the valley areas receive a great deal of insolation as the sun blazes down through cloudless skies, causing temperature to soar during the day. The result